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Report Number

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The USL/DEMS NASA/RECON Working Paper Series contains a collection of reports representing results of activities being conducted by the Computer Science Department of the University of Southwestern Louisiana pursuant to the specifications of National Aeronautics and Space Administration Contract Number NASW-3846. The work on this contract is being performed jointly by the University of Southwestern Louisiana and Southern University.

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WORKING PAPER SERIES

(NASA-CR-184515) A REPORT ON THE USL  
NASA/RECON PROJECT. PART 1: THE DEVELOPMENT  
OF A TRANSPORTABLE, UNIVERSITY LEVEL, IS AND  
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**A REPORT ON THE USL NASA/RECON PROJECT:**  
**PART I. THE DEVELOPMENT OF A TRANSPORTABLE,**  
**UNIVERSITY LEVEL, IS&R EDUCATIONAL PROGRAM**

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**October 4, 1984**

**This document represents a preprint of a paper that has been accepted for presentation at the 18th Annual Hawaii International Conference on Systems Sciences (HICSS-18), to be held in Honolulu, Hawaii, January 2-4, 1985, (to be published in the conference proceedings)**

### ABSTRACT

This paper describes a project which has as its goal the production of a set of system-independent, discipline-independent transportable college level courses to educate science and engineering students in the use of large-scale information storage and retrieval systems. This project is being conducted with the cooperation and sponsorship of the National Aeronautics and Space Administration (NASA) by research and development teams at the University of Southwestern Louisiana and Southern University.

Chapter I is an introduction which provides an overview of the project and a listing of the management phases. Chapter II furnishes general information regarding current accomplishments in all areas under development at present. Chapter III deals specifically with the development of the course materials by presenting a series of diagrams and keys to clearly depict the progress and interrelationships of various tasks and sub-tasks. Chapter IV presents plans for activities to be conducted to accomplish the completion and delivery of all course materials. The final chapter constitutes a summary of the project objectives, methods, plans, and accomplishments.

### ACKNOWLEDGEMENTS

Our primary debt is to the National Aeronautics and Space Administration for sponsoring this entire effort by means of NASA Contract NASW-3846. The agency provided more than just financial support; we also benefitted from a special, intensive, on-site NASA/RECON training workshop, NASA/RECON system access, and extensive documentation support. Particular thanks go to two extraordinary friends, John H. Wilson, Jr., the NASA Contract monitor, and Jack Kolb, Principal Army Technical Information Officer, Directorate for Technology Planning and Management and our Primary DoD contact person.

Special recognition must be extended to our USL cohorts on the NASA research team, namely, Frank Chum, Philip Hall, Dennis Moreau, and Spiros Triantafyllopoulos. Even though their first concern is NASA PC R&D applications development, they have provided us with input, support, expertise, and, especially, the leaven of common sense. Many other Computer Science students have contributed to the project as part of their course work and research at USL. In particular we would like to thank: Sherief El-Mougy, Susan Kneller, Siaw Ng, Kil-Hyun Nam, Lin Yan, Stamatis Marmaritsakis, Mufid Sokolovich, Jinous Bassari, Srinu Kavi, Alonzo Johnson, Amaresh Sripathi, I-Hsiung Liu, Wei-Chung Yu, K. S. Tang, and Carlos Pena.

Finally, although Dr. Wayne D. Dominick has refused credit for the authorship of this document, it is clear that neither this paper nor the NASA project could have come to fruition without his inspiration, cooperation, generosity, and hard work. Much of the material here draws heavily on the original R&D proposal, "NASA RECON: Course Development, Administration, and Evaluation," and "FY 1983-1984 Final Report to the National Aeronautics and Space Administration on NASA Contract Number NASW-3846," the first year progress report presented to NASA on September 1, 1984.

## 1. INTRODUCTION

The amount of information available through online bibliographic IS&R systems is already enormous and expanding at a rapid rate. Unfortunately, this wealth of information is not used to its full capacity. Employers complain that new graduates have very little expertise using such systems and are too dependent on manual research for information retrieval. The problem has, of course, been perceived by many IS&R vendors and very extensive and successful efforts are being made to extend the availability of systems [1]. There remains a need to educate potential users in the techniques of retrieving material from large-scale bibliographic systems. Schools must share this responsibility with the information industry; the field deserves to be taught as an academic subject [7]. This paper describes a project which has as its goal the teaching of such skills to large numbers of future scientists and engineers.

In December, 1983, the National Aeronautics and Space Administration (NASA) entered into a contractual agreement (NASA Contract Number NASW-3846) with the University of Southwestern Louisiana (USL) and Southern University (SU) for contracted research and development activities addressing the development, administration, and evaluation of a set of transportable, college-level courses to educate science and engineering students in the effective use of automated scientific and technical information storage and retrieval systems, and, in particular, in the use of the NASA/RECON system. This introductory chapter will provide a brief account of the NASA contract work which has been accomplished to date as well as an overview of the phases of the entire NASA sponsored project. A companion paper, "A Report on the USL NASA/RECON Project: Part II. PC-Based R&D in Support of IS&R Applications," [3] reports on research and development activities being performed as part of the NASA contract which are aimed primarily at the development of PC-based intelligent workstations and the creation of a PC-based NASA/RECON simulator which would be used to both lower the cost of administering the courses and to facilitate the addition of Computer Aided Learning into future versions of the courses.

## 1.1 OVERVIEW OF OBJECTIVES OF NASA CONTRACT

In order to provide an overview of the objectives of the activities currently being performed under NASA sponsorship, this section will highlight the major thrusts of our activities. These objectives are as follows:

Set of courses. The development of an educational program comprising a set of courses with varying depth of treatment on the principles and concepts of interactive information storage and retrieval systems and the specifics of effectively utilizing the NASA/RECON system. The course set includes:

- (1) 18 week full semester course
- (2) 12 week full quarter course
- (3) 6 week mini-course
- (4) 1-2 day intensive workshops.

Hands-on usage. The development of an educational program incorporating extensive hands-on interactive usage of NASA/RECON and other large-scale interactive information storage and retrieval systems.

Science and engineering students. The development of an educational program targeted at scientific and engineering disciplines; assumptions include instructors drawn from science and engineering faculties and students drawn from senior undergraduates in science and engineering.

Transportable courses. The development of fully transportable course materials available for wide distribution to colleges and universities throughout the United States. The course material development philosophy is predicated on a set of system-independent, discipline-independent core materials, with hooks for incorporating system-specific modules and discipline-specific examples throughout. The course materials currently under development are:

- (1) Course syllabi
- (2) Lesson plans
- (3) Visuals (Overhead transparencies)
- (4) Homework assignments with answer keys
- (5) Usage assignments with answer keys
- (6) Instructor notes
- (7) Additional support handouts
- (8) Examinations with answer keys
- (9) Bibliographies.

Additional course materials under consideration for development include textbooks, workbooks, and video tapes and films. Incorporation of these entries will depend on the final form of the courses and the evaluations of administering institutions.

## 1.2 MANAGEMENT PHASES OF NASA CONTRACT

In order to provide a coherent development plan for contract activities and assure proper delegation of responsibility for specific tasks, the entire project has been divided into the following stages:

- (A) Needs analysis
- (B) Course development
- (C) Pilot course administration
- (D) Pilot evaluation
- (E) Development of distribution plan
- (F) Implementation of distribution plan
- (G) Conduct of regional seminars

- (H) Conduct of on-site seminars
- (I) Coordination of request processing and information dissemination
- (J) Course state-of-the-art enhancements
- (K) Institutional surveys and evaluations
- (L) Graduated student surveys and evaluations
- (M) Periodic statistical summary reporting

Should contract participation be extended to additional systems, appropriate tailoring of this management plan will be performed.

## 2. CURRENT ACCOMPLISHMENTS

This section will briefly overview the portions of the NASA project which have been completed to date.

### 2.1 PROJECT CONTROL

The USL NASA Tasks/Status document is the primary project management and control report in use at USL. This document indicates the assignment, monitoring and management of each project task and sub-task associated with the NASA contract. This report identifies each task and its status by means of a task number, status indicator, responsible party, date identified, date completed, milestone date, and task description.

### 2.2 NEEDS ANALYSIS

The needs analysis phase identified 237 target scientific and engineering institutions to be surveyed. A questionnaire was developed and directed to these schools. The results have been summarized, analyzed and interpreted. Appendix A contains a brief digest of the results of the Needs Analysis Phase. Subsequent phases of the project show the influence of this input. For example, those responding to the needs analysis



survey were asked to indicate preferences for entries in the course materials packages. These responses were employed to guide the choice of course deliverables developed as discussed in Chapter III. The distribution plan to be developed and implemented once the course development phase is complete can also be expected to depend heavily on the results of the needs analysis phase.

### 2.3 COURSE DELIVERABLES

The set of course resources currently being designed includes the outline, visuals, instructor notes, homework assignments and keys, usage assignments and keys, handouts, examinations and keys, and lesson plans along with appropriate standards for the development and documentation of these entries. These documents are now in various stages from first drafts to virtual completion. All of these materials are intended to be part of the full semester course offering; other course configurations will draw from this material by judicious sub-setting processes.

### 2.4 PROJECT WORKING PAPERS

The primary project working paper series consists of documents produced as part of the NASA contract work. These include the original contract proposal, conference papers detailing the progress of the project, and research papers written by team members on topics germane to some phase of the course development or other research activities, for example, natural language query systems, knowledge-based systems, and man-machine interface characteristics. A full set of standards regarding the development, formatting, reviewing, and issuance of entries within the series is also included.

### 2.5 PC R&D WORKING PAPERS

This document set includes the specifications, objectives, and environment standards of the Personal Computer Research and Development (PC R&D) work being conducted as part of the NASA contract. This activity focuses on the evaluation of possible applications of PCs to information storage and retrieval environments and the development of prototypes of specific applications. Activities currently in progress include the

development of PC-based distributed workstations, a PC-based simulator of the NASA/RECON system, and support projects such as a statistical package and a video presentation system. Details of these documents and the activities associated with them can be found in "A Report on the USL NASA/RECON Project: Part II. PC-Based R&D in Support of IS&R Applications," a companion paper [3].

## 2.6 OTHER RESEARCH SUPPORT

This set of material includes the agenda, list of participants and evaluation results of a NASA/RECON Special Training Workshop which was held at USL from January 31 to February 2, 1984. Additional material includes two USL data bases which provide local searchable access to the literature being utilized by the NASA contract team in the development of educational materials and all files maintained as part of the contract. An extensive directory structure has been established on USL's MULTICS system to provide mainframe automated support for the tasks being addressed within the scope of the contract. Further miscellaneous support includes course documentation and a MULTICS workbench for centralized document processing and control.

## 3. COURSE DEVELOPMENT METHODOLOGY

The specific steps involved in developing the course materials are detailed in this chapter. These include the assignment of precedences to tasks, the determination of development schedules, and the establishment of the relationships among objectives.

### 3.1 CRITICAL CONSIDERATIONS

This section will address two critical aspects of the course deliverables, namely, standardization of course material documentation and modularity of the products. With respect to the issue of standardization, a set of standardized course material documentation templates ensures the standardization of all course deliverables. Templates have been developed and are currently in use for:

- (1) Course syllabi
- (2) Lesson plans
- (3) Visuals
- (4) Homework assignments
- (5) Homework assignment answer keys
- (6) Usage assignments
- (7) Usage assignment answer keys
- (8) Examinations
- (9) Examination answer keys.

Additional templates will be constructed as needed depending on the inclusion of subsequent entries in the course materials packages.

In light of the critical importance of course material transportability across educational institutions, and course material maintainability and extensibility over time, modularity of all course materials is a primary consideration of the entire course development process. This modularity is achieved via application of a few basic development principles:

Full-semester courses. The topical area coverage associated with the course of longest duration, the 18 week full semester course, is being defined first. With such defined coverage, all courses of shorter duration will be defined in a totally modular manner as subsets of the course of longest duration.

System independent courses. A conceptual, system-independent course syllabus structure was defined before addressing specific, system-dependent course components. This approach has a number of highly desirable benefits:

- (1) It formally differentiates system-dependent portions of a course from system-independent portions.

- (2) It ensures transportability of the system-independent portions of a course without any tailoring.
- (3) It greatly facilitates modular development of the system-dependent portions of a course and will aid in the phased production of such materials.
- (4) It ensures that all packages of system-dependent modules follow a consistent, standardized, and parallel set of development guidelines, both in terms of content and format.

These considerations should result in assuring the transportability of the course materials to any institution regardless of which information storage and retrieval system(s) that institution uses. These considerations will also improve the marketability of the final course deliverables.

### 3.2 COURSE DEVELOPMENT PROCESS DESCRIPTIONS

This section details the educational activities and sub-projects pursued as part of the NASA contract and the relationships which exist among these activities. In the interest of clarity, this section has been structured as a series of diagrams with accompanying keys.

### Overall Course Development Diagram

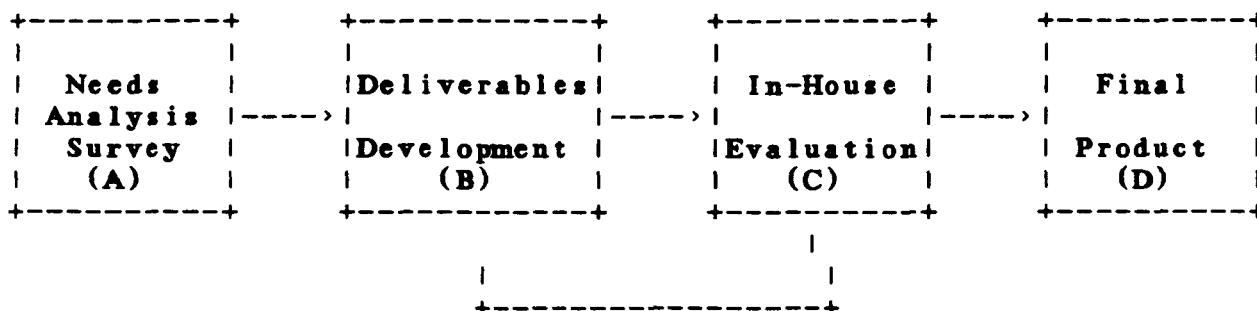


Figure 1

#### 3.2.1 Overall Course Development Diagram Key

The Needs Analysis Survey (Item A in Figure 1) provides indications of the types of institutions and students most likely to participate in the administration of the courses. It helps identify needs in IS&R instruction as perceived by the responding university representatives, and therefore dictates the particular topics to be selected for emphasis and the level of material proper for the final product. It also furnishes guidance as to the specific materials to be included in the deliverables packages. Finally, it shows which resources are available within the responding institutions. All this data helps the development team in its effort to produce not only a package of high quality, but one which is targeted to specific and diverse student populations.

The Deliverables Development block (Item B in Figure 1) concerns the actual flow of tasks and sub-tasks which produce each version of course materials. It is examined in detail in Section 3.2.2.

In-House Evaluation (Item C in Figure 1) is conducted on a regular basis at the end of each development period by selected members of the contract team who are not directly involved in producing course materials. These individuals have contributed to the project by assessing course sections for the following

criteria:

- (1) Completeness of coverage
- (2) Appropriateness of level
- (3) Adherence to standards
- (4) Smoothness of presentation
- (5) Intelligibility and value
- (6) Coordination of all entries

(Visuals, Lesson Plans, Homework, etc.).

Continuous evaluation is also performed by the team responsible for the actual design and production of course materials. This evaluation proceeds in an iterative fashion throughout each development period and, in addition to the previously cited criteria, assures proper:

- (1) Selection of material
- (2) Correctness of material
- (3) Provision of supporting material.

Note that the Deliverables Development block and the In-House Evaluation block form a loop which does not terminate until the deliverables under consideration are deemed acceptable according to all criteria appropriate to the development stage.

The Final Product block (Item D in Figure 1) indicates the termination of the process described above but may not be assumed to mean that the task is complete, only that one development period has successfully ended. Indeed, as indicated in Section 1.2, the course development process is intended to be continuous. The design of the courses will facilitate incorporation of state-of-the-art enhancements and additional systems participation, and will accommodate improvements suggested by participating institutions even after the initial full set of course entries is complete.

# Course Deliverables Development Diagram

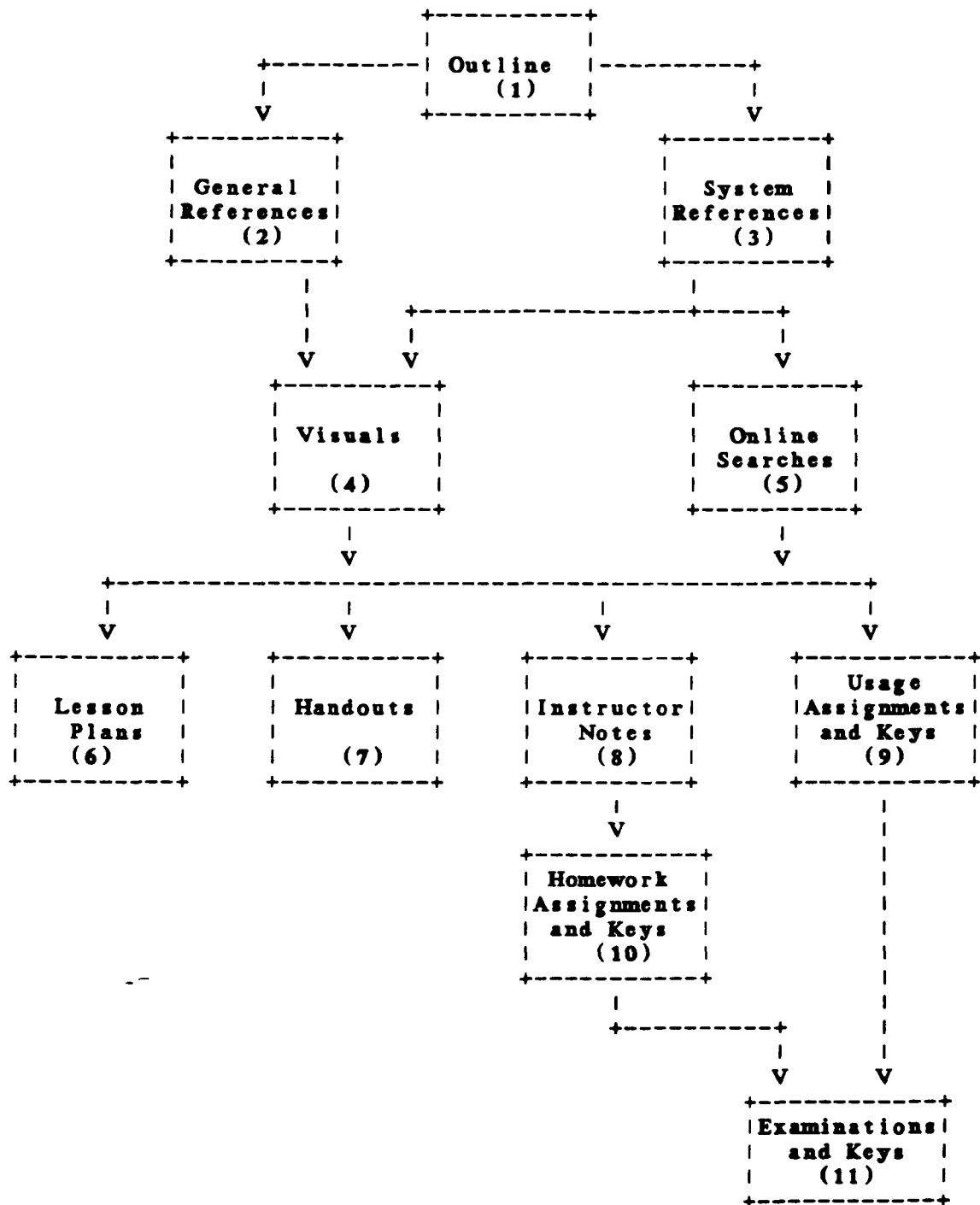


Figure 2

### 3.2.2 Course Deliverables Development Diagram Key

The Outline (Item 1 in Figure 2) provides the starting point for all activity; it is also the basis for the course syllabus.

General References (Item 2 in Figure 2) are consulted as a foundation for the universally applicable material in the transparencies and other course deliverables. All references used will be gathered into a bibliography to be included with the course.

System References (Item 3 in Figure 2) are consulted to provide tailored material for presentation within appropriate lessons. These references are also used to formulate and conduct searches on the systems involved.

The Visuals (Item 4 in Figure 2) represent the heart of the material actually presented in the classroom. These are not as fully developed as, for example, a textbook, but consist of topically organized material, presented in a consistent manner according to clearly stated specifications.

Online Searches (Item 5 in Figure 2) are conducted as a prerequisite to the production of Usage Assignments and Keys, as well as Handouts of sample searches, sample output, etc. to support material presented in the Visuals.

The Lesson Plans (Item 6 in Figure 2) are intended to indicate the thrust of each lesson, to provide a ready reference of materials needed and activities suggested for each class. Bookkeeping details are also managed as each Lesson Plan specifies which assignments are to be distributed or collected at a given class period along with a notation of outstanding usage and homework assignments. In addition, each Lesson Plan includes a list of suggested reading material which may be used by the teacher himself or passed along to the class.



Handouts (Item 7 in Figure 2) in general consist of excerpts from the NASA/RECON User's Manual [8], NASA Thesaurus, Vol. 1. Hierarchical Listing [9], and NASA Thesaurus, Vol. 2. Access Vocabulary [10], and output which illustrate the behavior of various languages, systems, and output facilities. Additional handouts include material to support specific lessons.

Instructor Notes (Item 8 in Figure 2) are Visuals expanded in an interlinear fashion with explanatory material, definitions, references, and so forth. The intention is to provide additional material for the teacher, presumably inexperienced in IS&R.

Usage Assignments (Item 9 in Figure 2) are designed to reinforce material presented in the classroom and to give practice to students in interaction with the NASA/RECON system. There are presently five such assignments and they provide the broadest possible experience in the shortest possible time. It is recommended that emphasis be placed on proper preparation before these assignments are attempted online, that is, students should consult the NASA/RECON User's Manual, and both volumes of the NASA Thesaurus to plan their searches. Questions about each assignment are included in order to provide reinforcement of the intended goals.

Homework Assignments (Item 10 in Figure 2) are designed to stimulate students to thought, discussion, and study. A few questions in each assignment require straightforward repetition of material presented in class but most will necessitate the application of principles learned in the classroom and/or some research for additional information. A few more difficult questions, marked by double stars (\*\*), have been included to provide challenges to those students who show high levels of interest, unusual skills, or, perhaps, the desire for extra credit.

The Examinations (Item 11 in Figure 2) are drawn from the Homework and Usage Assignments. For this reason, the timing of the course allows the instructor to present solutions to all assignments before testing of the skills involved. The package is organized in such a way that the instructor has sufficient time to grade and return the material to the students before the examinations.

System Incorporation Diagram

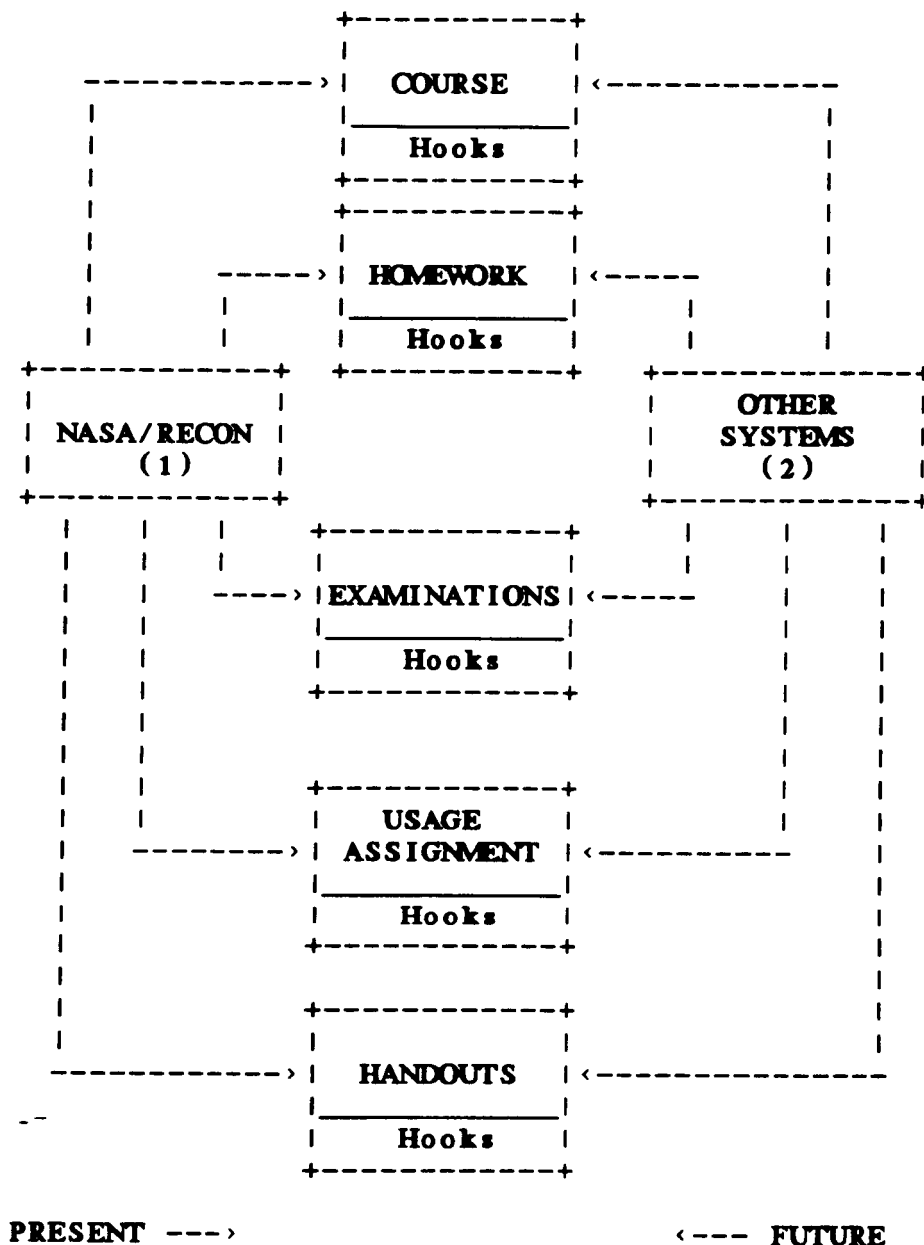


Figure 3

### 3.2.3 System Incorporation

As shown in Figure 3, NASA/RECON (Item 1 in Figure 3) is the source of all the system specific material included in the course at present. This refers to online modules such as sample searches, usage assignments and report generation examples, as well as offline modules such as excerpts from the NASA/RECON User's Manual and NASA Thesaurus. This material has been generated in part from documentation obtained from NASA and also from interactive sessions conducted by the contract team members.

Future contract participants' modules (Item 2 in Figure 3) will, likewise, be constructed from documentation and printouts of interactive search sessions. Such material is essential to all course deliverables with the exception of the syllabi which have been designed to be completely system independent.

It may be noted here that discipline specific material, intended to provide motivation for students through the inclusion of examples such as thesaurus entries, search subjects, reference documents, etc., will be generated according to the students' area of interest. It is the intention of the development team at present to develop two sets of intersubstitutable material, one for engineers and one for physical science majors. The diagram presented for System Incorporation, Figure 3, therefore, also represents the means of incorporating these discipline specific modules.

#### 4. PROJECTED FUTURE ACTIVITIES

This chapter is divided into short term, i. e., Contract Year 2, and long term sections in an attempt to present reasonable goals and appropriate milestones. The short term goals should be capable of achievement within the next Federal fiscal year; long term goals have no specific deadline but rather represent the fulfillment of all aspects of the long term contract objectives.

##### 4.1 CONTRACT YEAR 2 PLANS

The bulk of the work accomplished so far has been directed toward the achievement of entries A and B of the NASA contract management phases list (see Section 1.2). Phase A is Needs Analysis and phase B is Course Development. The research team engaged in this work is confident of completing a "stage ready" version of the 18 week full semester course materials package by the end of December 1984. Work still to be performed to achieve this goal includes completion of system-specific, discipline-specific handouts and associated visuals for incorporation in the course package. Editing of other deliverables such as the bibliography, outlines and assignments is nearing completion. The last task will be the finalization of the Examinations and Keys, exactly as indicated in the Course Development Diagram (see Section 3.2.2). While these materials are being finalized, a major in-house evaluation will be conducted by a separate group of graduate students in the Computer Science Department of USL as part of their course work in a graduate-level course entitled "Information Storage and Retrieval Systems." This additional review will help assure the quality of the final product.

January 1985 should see several contract phases occur in parallel. Phase B, Course Development, will be extended to incorporate the definition of the 12 week full quarter course, the 6 week mini-course, and the intensive workshop configurations. The entire project has been planned to facilitate this operation. By first defining the full semester course, the expectation is that successive removal of layers of detail from the most complex and most extensive course will allow the generation of shorter simplified versions. Thus, the 6 week course may be envisioned as embedded in the 18 week course and so

on as Figure 4 illustrates.

Development Plan for the Set of 4 Courses

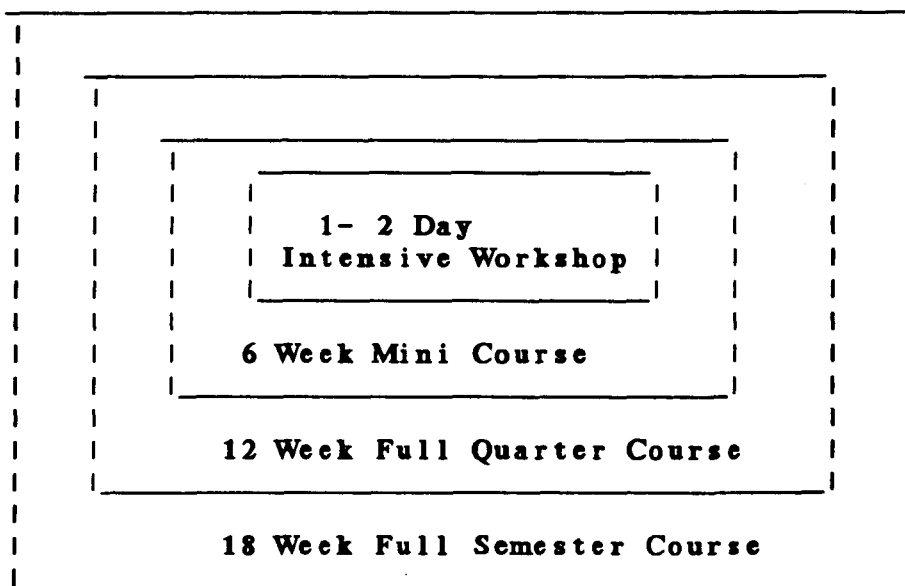


Figure 4

Phase C, Pilot Course Administration, should go into effect at the contracting institutions at this time. The juxtaposition of course instructors and course developers should facilitate any necessary adjustments and allow the rapid incorporation of suggested improvements even before the start of Phase D. This activity, Pilot Evaluation, will be formally conducted during the summer of 1985.

It is expected that the distribution plan development will be another activity on the January-June 1985 agenda. Using the needs analysis survey as a source document, a plan will be devised to appeal to potential participants based on their own stated needs and priorities. The results of the Pilot Administration and Evaluation Phases will contribute to the refinement of this plan so that it can be ready for implementation at the end of the 1984-1985 Federal fiscal year.

## 4.2 LONG TERM PLANS

This section will present some of the developments which are intended to be completed in future years. Figure 5 represents the development organization of the project. The initial course development for the 18 week full semester course (Item 1 in Figure 5) is basically complete. Minor updates will produce a Final Version (Item 2 in Figure 5) in the Spring of 1985. The incorporation of other systems (Item 3 in Figure 5) is an on-going process, with no set deadline. As soon as a final version is completed, marketing will be possible, with on-site demonstrations and distribution (Item 4 in Figure 5). Users' reactions and comments will necessarily bring some revisions and enhancements (Item 5 in Figure 5). Finally, future years will see expansion (Item 6 in Figure 5) of the courses and their materials package.

Development Organization

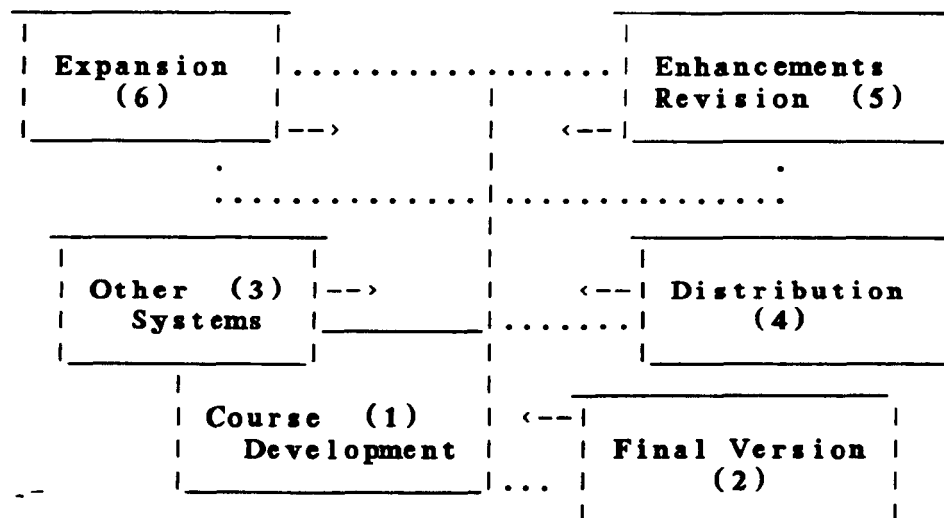


Figure 5

### 4.2.1 Distribution

These courses are being designed with transportability in mind. The success of this design is confirmed by the fact that two very different universities (USL and SU) are working simultaneously on

the same project. Transportability will allow extensive distribution to many institutions throughout the country. The marketing phase can be divided as follows:

Publicity and presentation. The courses will be offered to as many universities offering undergraduate degrees in physical science and engineering as possible (see management phases E and F). The intent of the courses will be clearly explained to the potential participant universities as well as the structure required in order to implement the course successfully at regional seminars organized and conducted as management phase G.

Demonstration. Once the candidate institution has recognized the value and quality of the courses, and expressed interest in offering them, on-site seminars and training sessions will be held in accordance with phase H. During those short meetings, instructors, assumed to be novices with regard to IS&R techniques and resources, will be presented with all the materials necessary for the courses. The entire collection of packages will be reviewed and all questions relevant to the courses will be answered.

#### 4.2.2 Expansion and Enhancement

The advantages of modular design for such courses are numerous. Individual requirements can be met, while preserving a consistent overall structure. Equally important, such a design allows constant revisions and updates, as well as inclusion of new systems.

These courses were originally discussed as being targeted for prospective NASA/RECON users. However, it rapidly became clear that students would benefit from exposure to other commercial and governmental systems. Thus, the developers of these courses are actively soliciting the participation of other systems, such as DIALOG, DOE/RECON, DTIC/DROLS, SDC/ORBIT, EPA/CSIN, LLL/TIS and others. The courses include multiple "hooks" allowing easy insertion of specific material, as well as extensive examples (see Figure 3). Each system included in a package will offer to the students different searching methods and access to different data bases. Time online on every system being studied will be provided to all students attending the courses; however, the

associated costing and funding issues remain to be resolved. Since the main objective of these courses is to educate students in the concepts and principles of interactive IS&R systems and techniques and in the art of effective searching, it is very important for the course to offer state-of-the-art information; this is focus of phase J. The design of these courses make such modifications and updates easy operations. For example, the inclusion of new systems, new examples, the revision of usage assignments and changes in questions for examinations will only be a matter of removing, updating or adding "hooks."

It is also recognized that the needs of universities and the facilities offered by IS&R systems will change in years to come. The courses will have to be revised as needed; thus, the ease of modification is doubly valuable.

#### 4.2.3 Evaluation

Once the course development is complete, a continuous process of review will begin. These evaluations will govern all future activities associated with the project. The courses will be offered by various institutions, tailored to their particular needs. For example, questions about the selection of systems, data bases, or the length of the courses will be resolved with the candidate institution. User satisfaction will be periodically checked as part of phase K, possibly through questionnaires. This will enable the research team to follow up on the users' stated needs, facilitating enhancements, changes and updates as planned in phase K. Support will be provided to all universities offering the courses. Phase I provides for the formation of a plan to receive, analyze, and answer all questions relating to the courses. Explanations will be given, changes will be made as needed, and, when questions are of general interest, the answer will be broadcast to all offering universities.

Phase L activities will involve the polling of graduated students who have participated in the course offerings. These reviews will ascertain the value of the course on the job and furnish suggestions for improvements from the trenches.

The final step in the management plan, phase M, provides for periodic statistical reporting to both course sponsors and



participating universities. Data will be collected concerning the number of participating institutions and students, frequency of course offerings, course configurations at various institutions, online system usage, effect on employability, and other parameters of interest. This data will be analyzed, summarized, and interpreted and finally reported back to all appropriate parties as part of the continuing evaluation of the project.

#### 4.2.4 Research

Parallel to the educational activities which have been presented in this paper, the University of Southwestern Louisiana supports a research and development group working on a number of supportive projects under the same NASA contract. The entire project is oriented toward facilitating user access to IS&R systems. This group presents its goals and orientations in "A Report on the USL NASA/RECON Project: Part II. PC-Based R&D in Support of IS&R Applications," a companion paper [3].

### 5. SUMMARY

This paper described the development of a set of courses designed to present the concepts of IS&R to engineering and science students. The project is sponsored by NASA with the intention of providing a multidisciplinary program for teaching concepts, principles and effective techniques for utilizing large-scale online bibliographic systems.

Simply stated, the courses must be adjustable as to length and level of detail, flexible as to IS&R systems and content examples incorporated, and completely self-contained as to coverage because of the presumed inexperience of both instructors and students. These goals are achieved by:

Modular construction. The modular construction of the courses themselves, allowing the addition and deletion of detail blocks and example packages according to the configuration(s) desired and the IS&R system(s) being presented.

Support material. The exhaustive amount of support material provided including bibliography, homework, tests, usage assignments, numerous handouts, and a very detailed set of instructor's notes.

All of this material is currently under development; much of it being virtually complete and ready for a piloting phase.

Immediate future plans call for the finalization of all course resources and the presentation of the 18 week full semester course at USL and SU. Concurrent work on planning the distribution of the material as well as incorporating additional systems is projected. More remote plans involve the continuous evaluation, extension and enhancement of the course materials. Research and development activities are also under contemplation in the area of PC-based scientific workstations, PC-based simulators, common command languages, PC-based networks, and other related and supportive topics.

It is hoped that this course will help graduating students become better and more efficient researchers and practitioners of information systems, making them more productive employees once in the job market. The understanding of IS&R systems and the habits acquired during the students' last year of school should ease the use of online bibliographic information systems by the graduates during their professional lives.

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## APPENDIX A

## OVERVIEW OF NEEDS ANALYSIS RESULTS

During FY 1983-1984, a transportable information storage and retrieval system courses needs analysis questionnaire was developed and distributed to 237 colleges and universities throughout the United States. The questionnaire was completed and returned by 161 respondents (typically at the level of Academic Vice-Presidents, Deans of Colleges of Physical Sciences, and Deans of Colleges of Engineering).

A very brief overview of some of the major results of the questionnaire follows:

- (1) Computer usage is viewed as a very important or important educational objective in Engineering by 86.8% of the respondents and in Physical Sciences by 68.2% of the respondents.

[Results are highly complementary to our educational objectives.]

- (2) Availability of local computing access facilities is substantial, for example, responses indicate that substantial departmental computer terminals exist (86.7% in Engineering, 79.7% in Physical Sciences) and even substantial departmental personal computers exist (66.7% in Engineering, 59.3% in Physical Sciences).

[Results indicate that availability of local computer access facilities will not be a problem in the local implementation of our online, hands-on oriented educational programs.]

- (3) A substantial number of colleges and universities do already have access to one or more IS&R systems (72.0%); that these systems are typically available to all Engineering departments (68.2%) and/or to all Physical Science departments (76.6%). However, while these systems are typically available to all faculty (98.3%), to all staff (90.4%), to all students for coursework (68.7%), and to all students for research (87.0%), they are typically being used almost exclusively by librarians (94.8%) and in only 8.6% of the colleges and universities responding were students reported as conducting searches themselves!

[These results provide very strong justification for the need for our educational programs targeted at hands-on use of IS&R systems by the end-users themselves, e.g., students, faculty, and researchers, in contrast to library intermediaries.]

- (4) With respect to college and university interest in offering Physical Science and Engineering students an opportunity to learn the principles and concepts of online IS&R systems and interact with such systems, only 2.5% of the respondents replied in the negative; 67.7% responded "YES", 21.7% undecided, and 7.5% responded that they are presently doing so.

[Results indicate strong interest in the areas that our educational programs are addressing.]

- (5) Funding was identified as the major obstacle to course implementation (82.1%).

[Our PC R&D activities are addressing a number of potential solutions to the known high costs (vendor search time costs, telephone costs, telecommunications costs) of providing substantive, online, hands-on usage of large-scale IS&R systems.]

- (6) An overwhelming majority (86.4%) of the colleges and universities responding indicated interest in incorporating a pre-packaged program (as we are developing) into their curriculum when such programs become available. Again, the most frequently mentioned qualification (81.5%) was funding support.

[Results again represent strong justification for our programs and strong justification for our planned cost reduction approaches via PC R&D activities.]

- (7) With respect to the types of educational material to be incorporated within the pre-packaged educational programs, respondents indicated their desire for virtually all of the types of educational material that we are planning to develop, including course syllabi (73.5%), hands-on usage assignments and keys (65.2%), support handouts (62.1%), workbooks (60.6%), overhead transparencies (55.3%), lesson plans (53.8%), textbooks (51.5%), homework assignments and keys (49.2%), videotapes/films (47.7%), and bibliographies (43.2%). Only discussion topics (39.4%) and examinations and keys (38.6%) were requested by less than 40% of the

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respondents.

[Again, the results provide strong justification for the need for the types of educational materials that we are developing and incorporating within the educational programs.]

The complete details and supporting documents associated with our progress within the Needs Analysis Phase of the contract work can be found in items 2.1 through 2.4 of "FY 1983-1984 Final Report to the National Aeronautics and Space Administration on NASA Contract Number NASW-3846" [5].

4.8

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16. Abstract  <p>This Working Paper Series entry describes a project which has as its goal the production of a set of system-independent, discipline-independent transportable college level courses to educate science and engineering students in the use of large-scale information storage and retrieval systems. This project is being conducted with the cooperation and sponsorship of NASA (National Aeronautics and Space Administration) by research and development teams at the University of Southwestern Louisiana and Southern University. Chapter I is an introduction which provides an overview of the project and a listing of the management phases. Chapter II furnishes general information regarding current accomplishments in all areas under development at present. Chapter III deals specifically with the development of the course materials by presenting a series of diagrams and keys to clearly depict the progress and interrelationships of various tasks and sub-tasks. Chapter IV presents plans for activities to be conducted to accomplish the completion of delivery of all course materials. The final chapter constitutes a summary of the project objectives, methods, plans, and accomplishments.</p> <p>This report represents one of the 72 attachment reports to the University of Southwestern Louisiana's Final Report on NASA Grant NGT-19-010-900. Accordingly, appropriate care should be taken in using this report out of the context of the full Final Report.</p>			
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